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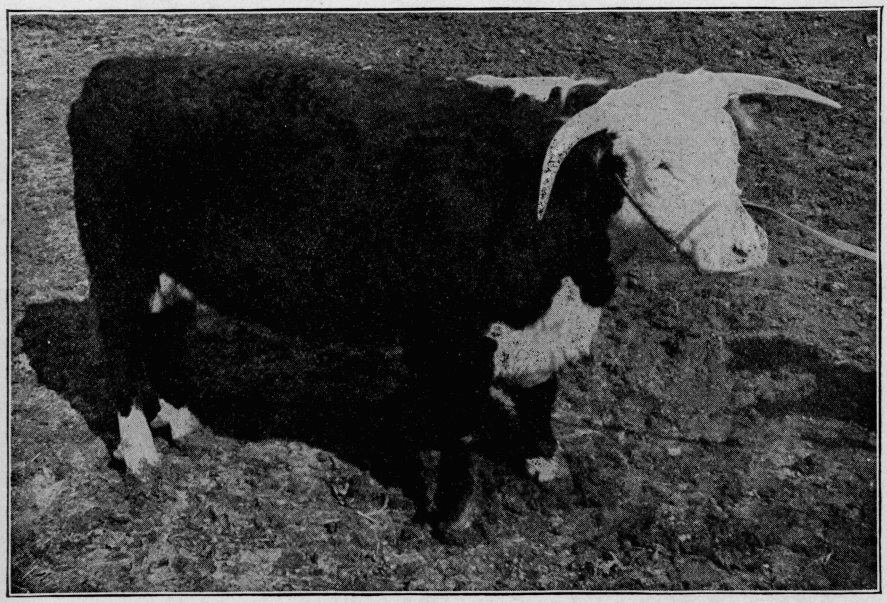
TEXAS AGRICULTURAL EXPERIMENT STATIONS

BULLETIN No. 86

ANIMAL HUSBANDRY SECTION, SEPTEMBER, 1906

CATTLE FEEDING EXPERIMENTS

I. MOLASSES FOR FATTENING CATTLE
II. ROUGH RICE AS A STEER FEED
III. PROFIT FROM DIFFERENT SYSTEMS OF FEEDING CATTLE



A MOLASSES EATER

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MOLASSES FOR FATTENING CATTLE.

BY JOHN A. CRAIG AND F. R. MARSHALL.

Within recent years black strap molasses has become one of this State's staple stock feeds.

In January, 1903, the Chemical Section of this Station published a press bulletin giving the composition of black strap molasses and calling attention to its value to feeders using cottonseed meal and hulls. The same season Mr. Carson finished a feeding experiment in which molasses was one of the feeds tested. The results of this experiment are reported on page 17, of Bulletin 76.

SOURCE OF FEEDING MOLASSES.—The cane molasses sold for feeding purposes is the refuse after all the crystalized sugar obtainable has been taken from the concentrated juice of the cane. "It is a thick, black mass, having somewhat the appearance of coal tar, but a pleasant odor and sweet taste."* It runs on an average about twelve pounds to the gallon, or 170 gallons to the ton. The Texas factories produced from the 1904 crop 32,500 barrels of this molasses. Of this amount 3,000 barrels were sold to the cattle feeders of this State.

COST OF MOLASSES.—The sugar refining companies offer feeding molasses in barrels at 6 cents per gallon. A barrel contains on an average 50 gallons or 600 pounds. The same factories quote the molasses in tank cars at 2½ cents per gallon. The cost of barrels and filling therefore adds 3½ cents per gallon to the cost at which it is furnished to feeders. The freight rates for car loads in barrels transported 100 miles over a single line of railroad is 26 cents per hundred pounds. In tank cars the rate is 14 cents per hundred pounds from Sugarland to Dallas and San Antonio, and similar rates are quoted from other points. All the molasses used in our experiments was furnished by the following firms, who are anxious to encourage the use of this product for stock feeding:

Ed. H. Cunningham & Co., ... Sugarland, Texas.
Penitentiary Farm, Jno. L. Wortham, Agt., Huntsville, Texas.
Arcola Sugar Mills Co. ..... Houston, Texas.
Lakeside Sugar Refining Co., ... Lakeside, Texas.

COMPOSITION OF FEEDING MOLASSES.—A great deal has been written regarding the feeding value of beet molasses. As early as 1874,

*Press Bulletin, Vol. IV., No. 1.

German writers discussed the best methods of utilizing this valuable product in the feeding of live stock. The nature of the beet molasses differs so materially from that of the cane molasses that the teachings of the experiments of the former are not applicable to our cane product. The composition of these two kinds of molasses is shown:

	Louisiana* cane Molasses: Black Strap	Beet Molasses
Water	20.93%	23.70%
Cane Sugar	30.73%	46.7 %
Reducing sugars	29.67%	.6 %
Ash (salts)	8.85%	13.20%
Organic non-sugar	9.82%	15.8 %
Total	100.00%	100.00%

*C. A. Browne in Breeders Gazette, March 8, 1905.

The analysis of cane molasses published by Dr. Harrington in January, 1903, is as follows:

Specific Gravity	1.4 %
Free Acid (calculated as acetic acid)	3.4 %
Invert Sugar	18.74%
Cane Sugar	22.61%
Total Sugar (carbhydrates)	41.35%
Protein or Albuminoids	2. %
Ash	6.26%

It will be seen that the total carbhydrate content varies from 41 per cent to 70 per cent. While there have been no special experiments reported in which the digestibility of the nutrients in cane molasses was determined, there is evidence to justify the assumption that the carbhydrates are entirely digestible while the protein has no value as such.

Early Experiments.—Although it has become common practice to use this molasses in feeding work stock on sugar plantations, other stations have not reported any attempts to use it in the production of beef. In December, 1890, Carson and Gulley at this station secured from feeding cottonseed meal and silage to four steers averaging in weight 737 pounds, a daily gain of 2.54 pounds at the cost of 3.83 cents per pound. A similar lot eating the same feed with the addition of one-half pint of molasses per steer per day gave an average gain of 2.22 pounds, costing 4.6 cents per pound. Molasses was charged at 20 cents per gallon. In adding molasses to a cottonseed meal and hulls ration the result was more favorable to molasses. Steers weighing 4713 pounds, fed for 90 days on meal and hulls gained 2.27 pounds each per day at a cost of 3.72 cents per pound. By adding to this ration one-half pint molasses daily for each steer a gain of 2.65 pounds was secured at the same cost, molasses being charged at the same price as in the previous experiment. A gain of 2.8 pounds costing 4.1 cents was made by another lot receiving one-fifth more molasses than the lot just mentioned.

TABLE I.—SUMMARY OF RESULTS OF FEEDING MOLASSES FOR A NINETY DAY PERIOD AS REPORTED BY CARSON AND GULLEY IN BULLETIN NUMBER TEN.

No. of Lot	Average Wt. at Start	No. Steers	Feed Eaten Per Steer	Total Gain	Average Daily Gain Per Steer	Food Cost Per lb. Gain
4	731.2 lbs.	4	3401.6 lbs. silage 507.5 lbs. cottonseed meal 3.62 gals. molasses	800	2.22 lbs.	4.6c
5	737.5 lbs.	4	3822.47 lbs. silage 496.4 lbs. cottonseed meal	915	2.54 lbs.	3.83c
7	713.75 lbs.	4	1564 lbs. cottonseed hulls 534 lbs. cottonseed meal	825	2.27 lbs.	3.72c
10	727.5 lbs.	4	1677.7 lbs. cottonseed hulls 530.5 lbs. cottonseed meal 5.57 gals. molasses	955	2.65 lbs.	3.74c
11	868.3 lbs.	3	1884 lbs. cottonseed hulls 599.6 lbs. cottonseed meal 7.48 gals. molasses	1006	2.79 lbs.	4.1c

Though on account of high cost of molasses, lots eating it made expensive gains, their gains were greater than those made by all but those receiving silage.

In the 1903 experiment referred to as having been reported on page 17, of Bulletin 76, the addition of one-fifth gallon of molasses to a cottonseed meal and hulls ration gave an increase of one-half pound in the daily rate of gain at an increased cost of one-tenth of a cent.

METHODS OF FEEDING MOLASSES.—The most common method of using barrel molasses is to carry it out in buckets and mix it by hand with feed in the bunk. In all our experiments the molasses was mixed with an equal volume of water and poured over the mixed grain and hulls, the whole then being thoroughly stirred. This, however, entails too much labor to be profitable when feeding on a large scale. A common practice is to take a spraying outfit, the barrel being filled with equal parts of water and molasses, and drive through the feed lot, spraying on the mixed feed in bunks such amount of the mixture as is to be fed. This practice in some degree prevents the loss occasioned by the feed being blown from the bunks. Feeders who mix meal and hulls in the mill, buy their molasses in tank cars, empty it into storage tanks in proximity to the mixing room and mix it with the meal and hulls before

loading it into the feeding wagon. Others recommend allowing steers constant access to molasses. Our experience with this method is reported on page 14.

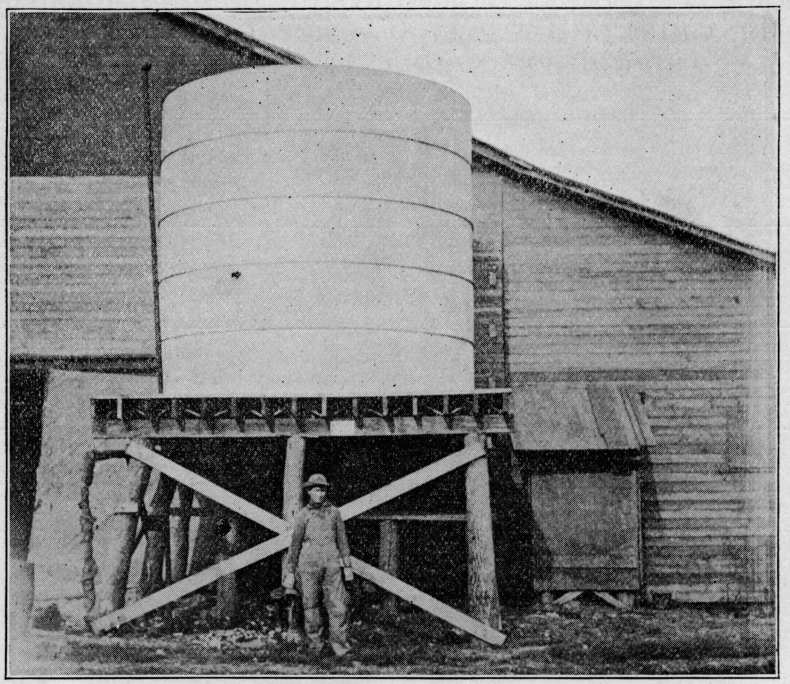

Plate I.—Storage tank for molasses used by W. C. Furneaux at Midlothian. The small lean-to on the right encloses a smaller tank into which molasses is drawn to be thinned by steam from the boiler. The thin molasses is drawn into large sprinkling cans in the mixing room and sprinkled over the meal and hulls.

EXPERIMENT No. I.—FEEDING MOLASSES TO TWO-YEAR-OLD STEERS BEING FINISHED FOR MARKET.

In this experiment which commenced January 1, 1905 and continued until March 11, eighteen steers coming three years old were used. They were all well graded and dehorned Herefords, having been obtained from the Santa Gertrudes ranch as yearlings. They had been on feed since February, 1904, and when put into this experiment their average weight was about 1100 pounds. They were divided into three lots of six head each as nearly uniform in all characteristics as it was possible to make such small lots.

Lot I. Received heavy feed of molasses.
Lot II. Received light feed of molasses.
Lot III. Received no molasses.

These cattle had been on feed so long that it was considered unsafe to use a large ration of cottonseed meal. The grain ration contained

about one pound cottonseed meal to two of corn chops, and cottonseed hulls only was used as roughage. All the steers ate on an average 12½ pounds of hulls and 14 pounds cottonseed meal and corn chops mixture each per day. On January 9th, the ninth day of the experiment, lots I and II were eating one quart of molasses daily for each steer. By January 21st, lot I was eating two quarts per steer per day, and by February 15th the six head were consuming daily 19 quarts of molasses. These steers had been fed so long and were so nearly fat that it was impossible to use the same amounts of hulls which shorter fed cattle would profitably consume. In fact this feeding was properly intended to test the value of molasses for maintaining the usually decreasing gains returned in the last weeks of a long feed. Nineteen quarts of molasses was the greatest quantity that could be satisfactorily mixed with 80 pounds of hulls. It being impossible to increase the hulls for the reasons given, the molasses ration was allowed to remain at the amount mentioned. During the second week of February, lot II, (receiving light molasses) did not eat so well as the other lots. Owing to the very bad weather which had then prevailed for some time, difficulty was experienced in keeping all the lots eating properly. It was some time before lot II were again eating a full ration, and inasmuch as there was no reason whatever to suppose their condition was attributable to the feeding of molasses they were taken out of the experiment. Feeds were calculated at the following prices:

Cottonseed hulls	$ 4.50 per ton.
Cottonseed meal	22.00 per ton.
Corn chops	21.60 per ton.
Molasses	.06 per gal.

TABLE II.—THE RECORD OF LOT I. RECEIVING HEAVY MOLASSES, AND OF LOT III, RECEIVNG NO MOLASSES FOR A SEVENTY-DAY PERIOD ARE SHOWN.

No. of Lot	Average Wt. at Start	No. Steers	Feed Eaten Per Steer	Total Gain	Average Daily Gain per Steer	Food Cost per lb. Gain
1	1113 lb.	6	5122 lbs. cottonseed meal 1450 lbs. cottonseed hulls 2919 lbs. corn chops 231 gals. molasses	720 lbs.	1.71 lbs.	10.05c.
3	1086 lbs.	6	5322 lbs. cottonseed hulls 1484 lbs. cottonseed meal 2940 lbs. corn chops	535 lbs.	1.27 lbs.	11.3c.

It will be seen that the cattle that received the liberal allowance of molasses made larger and cheaper gains than those that received no molasses. From these two lots and the original lot II, which were fully recovered, 15 head, shown in Plate II, were selected for exhibition at the Fort Worth Fat Stock Show, March 21st, 22nd and 23rd. They won first prize over five other loads of fat two-year-olds, were reserve champion car-load of the show, and were sold at $5.50 per hundred.

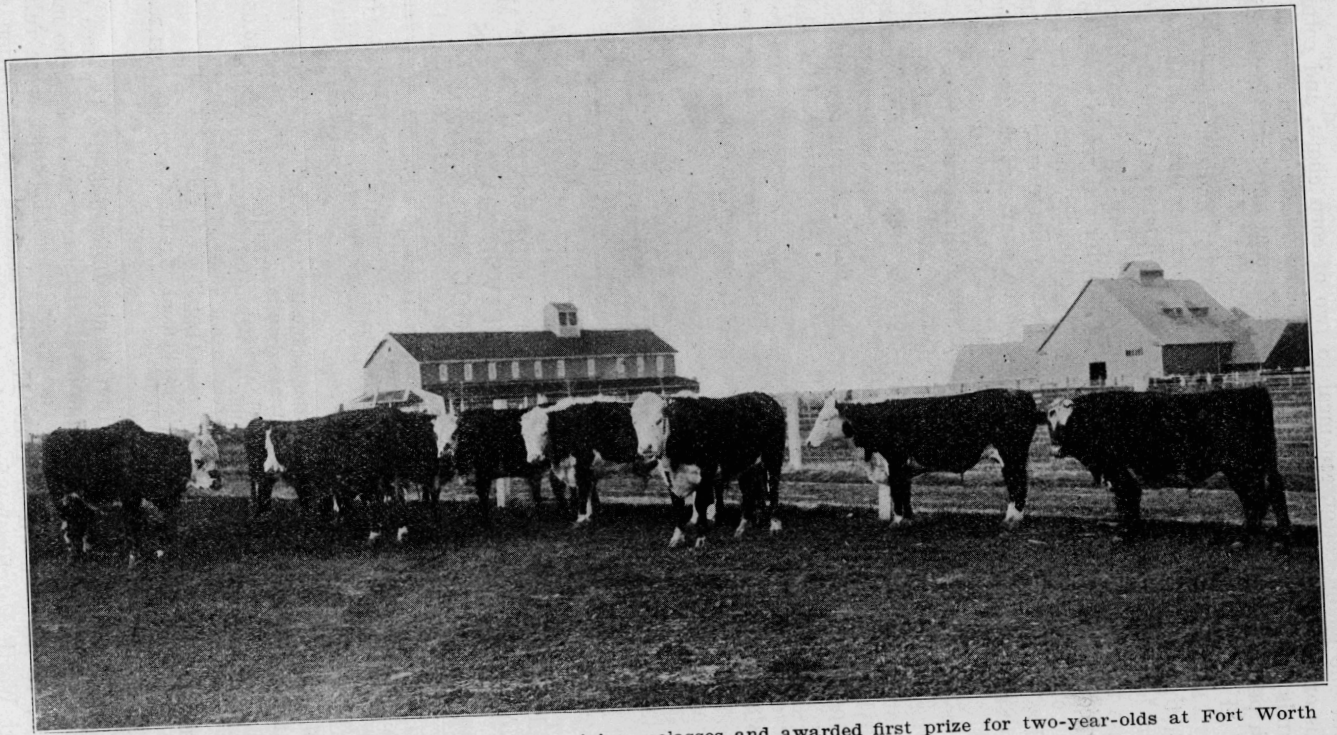

Plate II.—Carload of steers finished on a ration containing molasses and awarded first prize for two-year-olds at Fort Worth in March, 1905.

EXPERIMENT II.—FEEDING DIFFERENT AMOUNTS OF MOLASSES TO YEARLING STEERS.

While experiment I was important, yet owing to their nearly fat condition, the cattle were not representative of the stock that goes into Texas feed lots; neither was use of corn chops in the ration typical of the present practice of those parties who ask for information regarding molasses.

On February 1st, 1905, we commenced another experiment, in some ways similar to the first. This experiment continued until May 11th (100 days feeding) and included nearly all of the severe weather of that season. None of the lots had any shelter except during two of the worst nights when they were allowed to stand in the gangway of one of the sheds being used for other stock. The stock used consisted of 18 head (three lots of six head each) of high grade Herefords coming two years old. They were brought to the Experiment Station in February of the previous year and were on pasture until Christmas, 1904. While on pasture they received a light grain ration. After September, however, the grain ration did not make up for the scarcity of grass and when brought into the yards in December they were in rather low condition. The preliminary feeding extended all through January; cottonseed meal and hulls was the feed used, and by the time for the commencement of the experiment they averaged 671 pounds and were in nice healthy condition.

The object of this experiment was to study the relative values of cottonseed meal and hulls, cottonseed meal and hulls with a light feed of molasses, and cottonseed meal and hulls with a heavy feed of molasses. The lots were fed as follows:

Lot I. Cottonseed hulls, cottonseed meal, heavy feed of molasses.
Lot II. Cottonseed hulls, cottonseed meal, light feed of molasses.
Lot III. Cottonseed hulls, cottonseed meal.

First Month.—Owing to the scarcity of hulls it was impossible to feed those cattle as much roughage as was intended. At no time did they receive more than 13 pounds each of hulls per day. Throughout February the daily meal and hulls ration was the same for all the lots, namely: 13 pounds of hulls and 4 pounds of cottonseed meal per head. By February 19th, the steers in Lot I were eating two quarts each of molasses per day, and Lot II one quart, Lot III receiving no molasses.

The results of this month's feeding are shown. Feeds were charged at the following prices:

Hulls	$ 4.50 per ton.
Cottonseed meal	22.00 per ton.
Corn Chops	21.60 per ton.
Molasses	.06 per gal.

TABLE III.—ADDITION OF VARIOUS AMOUNTS OF MOLASSES TO A COTTONSEED MEAL AND HULLS RATION FOR 28 DAYS IN FEBRUARY.

No. of Lot	Average Wt. at Start	No. Steers	Feed Eaten	Nutritive Ratio	Total Gain	Av. Daily Gain per head	Feed Cost per lb. Gain
1	678.6 lbs.	6	2136 lbs. cottonseed hulls 769 lbs. cottonseed meal 52 gal. molasses 12 lbs. corn chops	1 to 5.4	568 lbs.	3.38 lbs.	2.91c.
2	688.6 lbs.	6	2136 lbs. cottonseed hulls 769 lbs cottonseed meal 33 gal. molasses 12 lbs. corn chops	1 to 4.8	418 lbs.	2.48 lbs.	3.68c.
3	645 lbs.	6	2136 lbs. cottonseed hulls 769 lbs. cottonseed meal 12 lbs. corn chops	1 to 3.9	235 lbs.	1.39 lbs.	5.7c.

SECOND MONTH—It was decided during February to feed all the cattle used in this experiment until the following December. It was impossible to feed for such a length of time on a heavy ration of cottonseed meal and hulls, so corn chops was added to the feed of all the lots. They continued to eat the same amounts of molasses as in February, except that during the last five days of March, Lot I was raised to a total of 15 quarts of molasses per day. Molasses as a source of nutrients is deemed especially valuable on account of its carbhydrate content. This being true, the lot receiving no molasses might now be expected to more nearly equal the molasses fed lots in gains than when receiving meal and hulls without corn.

The record of the three lots for March is shown:

TABLE IV.—ADDITION OF MOLASSES TO A RATION OF COTTONSEED MEAL AND HULLS AND CORN CHOPS FOR TWENTY-EIGHT DAYS IN MARCH.

No. of Lot	Average Wt. at Start	No. Steers	Feed Eaten	Nutritive Ratio	Total Gain	Av. Daily Gain per Head	Feed Cost per lb. Gain
1	773.3 lbs.	6	2418 lbs. cottonseed hulls 567 lbs. cottonseed meal 675 lbs. corn chops 96 gals. molasses	1 to 9.2	490 lbs.	2.63 lbs.	5.04c.
2	758.3 lbs.	6	2418 lbs. cottonseed hulls 567 lbs. cottonseed meal 675 lbs. corn chops 46 gals. molasses	1 to 7.6	442.5 lbs.	2.38 lbs.	4.92c.
3	684.2 lbs.	6	2418 lbs. cottonseed hulls 567 lbs. cottonseed meal 675 lbs. corn chops	1 to 6.2	415 lbs.	2.23 lbs.	4.75c.

The differences in the gains and their cost are not so great as before corn chops was used. The heavier molasses, while giving greater gains also produced them at greater cost. In preparation for immediate marketing this greater cost might be more than repaid by the added finish.

THIRD MONTH.—This period really covers from March 29th to May 11th. As in the latter part of March, the uniform daily ration to all the steers was 13 pounds hulls, three pounds cottonseed meal and four pounds corn chops to each steer. By April 9th, each steer in Lot I was eating three quarts of molasses per day, and in Lot II, two quarts, which amount they continued to eat until the close of the experiment. Lot III were getting too far behind the others in weight, the other two lots having been given increased amounts of molasses, Lot III was started on a light feed of molasses and by April 9th, each steer was eating one quart per day and so continued until the close. Also commencing April 21st, each steer ate five pounds daily of cured new alfalfa hay for the remaining time of the experiment. The record of the lot for the last period is shown in the table.

TABLE V.—ADDITION OF VARIOUS AMOUNTS OF MOLASSES TO A RATION CONSISTING OF COTTONSEED MEAL, HULLS, CORN CHOPS AND ALFALFA HAY, FOR FORTY-FOUR DAYS.

No. of Lot	Average Wt. at Start	No. Steers	Feed Eaten	Nutritive Ratio	Total Gain	Av. Daily Gain per Head	Feed Cost per lb. Gain
1	855 lbs.	6	2994 lbs. cottonseed hulls 738 lbs. cottonseed meal 984 lbs. corn chops 630 lbs. alfalfa hay 177.5 gals. Molasses	1 to 9.3	567.5 lbs.	2.31 lbs.	6.92c
2	832 lbs.	6	2994 lbs. cottonseed hulls 738 lbs. cottonseed meal 984 lbs. corn chops 630 lbs. alfalfa hay 112.5 gals. molasses	1 to 8	467.5 lbs.	1.9 lbs.	7.57c
3	753.3 lbs.	6	2994 lbs. cottonseed hulls 738 lbs. cottonseed meal 984 lbs. corn chops 630 lbs. alfalfa hay 53.25 gals. molasses	1 to 6.9	502.5 lbs.	2.04 lbs.	6.30c

In the foregoing period, Lot III, when put upon molasses ration made larger gains than Lot II. and somewhat cheaper than Lot I.

TABLE VI.—THE RECORDS OF THE THREE LOTS FOR THE ENTIRE ONE HUNDRED-DAY PERIOD IS SHOWN.

No. of Lot	Average Wt. at Start	No. Steers	Feed Eaten	Total Gain	Av. Daily Gain per Head	Feed Cost per lb. Gain
1	678.6 lbs.	6	7548 lbs. cottonseed hulls 2074 lbs. cottonseed meal 1671 lbs. corn chops 630 lbs. alfalfa hay 325.5 gallons molasses	1625	2.71 lbs.	4.95c
2	688.6 lbs.	6	7548 lbs. cottonseed hulls 2074 lbs. cottonseed meal 1671 lbs. corn chops 630 lbs. alfalfa hay 192 gallons molasses	1328	2.21 lbs.	5.46c
3	645 lbs.	6	7548 lbs. cottonseed hulls 2074 lbs. cottonseed meal 1671 lbs. corn chops 630 lbs. alfalfa hay 53.25 gallons molasses	1152.5	1.92 lbs.	5.55c

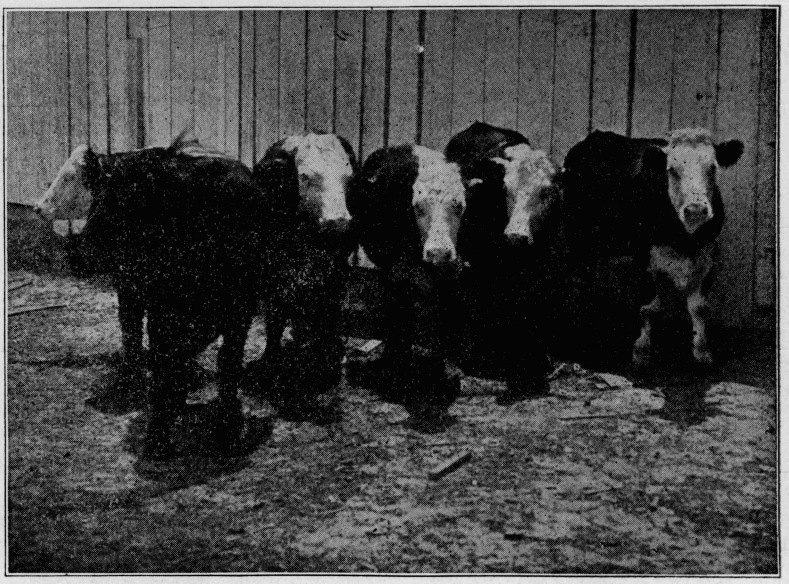

Plate III.—Six steers composing Lot I. These steers each consumed, on an average, over half a gallon of molasses daily for 100 days. For 40 days of that time they ate ¾ of a gallon each day. Photo taken at close of experiment.

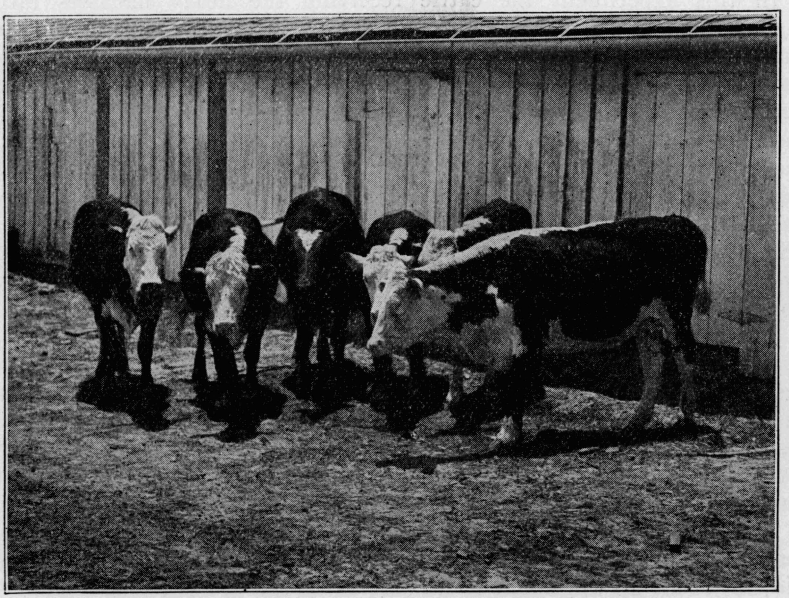

Plate IV.—Steers in Lot II, which received less molasses than Lot I, as they appeared at close of test.

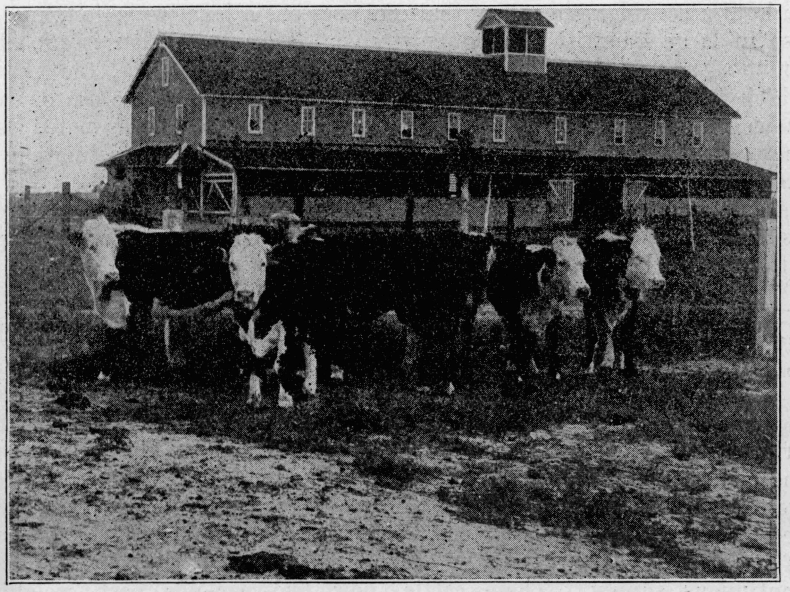

Plate V.—Lot III, which received molasses for last month only, at close of test.

In this experiment the cattle receiving the heavy molasses ration made the greatest gains all through the experiment. During the time that corn was being fed, however, the additional pounds of gain would not pay the extra cost of feed; however, the molasses fed cattle approached marketable condition much more rapidly, and owing to their superior condition had increased in value per pound more than the cattle receiving no molasses. During the first month, when molasses was added to a ration of cottonseed meal and hulls, the gains were especially increased. As to whether or not this rate of increase here attributable to use of molasses might reasonably be expected to continue over a longer period of meal and hulls feeding this experiment gives no indication.

The appearance of the different lots at the close of the experiment is shown in the accompanying cuts. All the cattle were too young and light at the beginning of the experiment to be put into marketable shape in 100 days. Lot I, receiving, during the last month, 3 quarts of molasses per steer daily, were not only fatter and heavier than both the other lots, but were in much better bloom. In this respect Lot III, even after having had molasses during the last month, did not show the condition of skin and hair exhibited by the other lots. All the lots ate their feed readily at all times but when molasses was most freely used the steers did not clean up the bunks so quickly as in the dry fed lots.

Amount of Molasses to Feed:—Those feeders who have been using molasses as a cattle food, have in most instances restricted its use to a quart per day, mixing it with the feed principally to render it more palatable, inducing the cattle to consume greater amounts. The idea prevails to a considerable extent that molasses has a laxative action, and its use in large quantities is not advisable. This impression is probably founded upon the experience of feeders of beet molasses, the ash of which is more abundant and contains more potash than the ash of cane molasses. Although observing very closely, we have never noted that increase in amount of molasses fed caused any more inclination to scour than follows the too rapid increase of any new feed. So far as the danger of scouring is concerned there is no reason to refrain from using molasses in the same manner as in any other feed of similar composition would be used.

EXPERIMENT III.—FEEDING MOLASSES FROM TROUGH TO CATTLE ON GRASS.

At the close of experiment II, Lot II was divided and added to the original lots I and III, which two lots were increased to ten head each by the addition of other animals of same age and weight. These two lots were turned on grass and fed similarly except that one lot was allowed access to a tight bottomed feed bunk in one end of which a barrel of molasses was placed and gauged to run fast enough to make sure of continuous supply. These cattle, now two-year-olds past, weighing about 900 pounds and eating twelve pounds grain each per day, principally corn, at the start ate molasses at the rate of six pounds or two quarts each per day. They continued to take increasing amounts of the

molasses until in the third week they were taking twelve pounds (one gallon) each daily. Some steers seemed especially fond of the molasses and ate it in such large quantities as to cause them to scour. This is the only experience we have had with the system of feeding clear molasses separately. The grass on which the cattle were dependent for roughage was very washy and so scarce that at no time were they as well filled as is desirable. It may be that with free access to molasses where the bunks are always full of hulls, the result would be more satisfactory.

The record of these two lots for sixty days of feeding as just described, is shown:

TABLE VII.—FEEDING MOLASSES AD LIBITUM TO CATTLE ON GRASS FOR SIXTY DAYS.

No. of Lot	Average Wt. at Start	No. Steers	Feed Eaten	Total Gain	Av. Daily Gain	Feed Cost per lb. Gain
1	924.7 lbs.	10	1110 lbs. cottonseed hulls 1310 lbs. cottonseed meal 300 lbs. alfalfa hay 5½ gallons molasses 5113 lb. corn chops	582	.97 lbs.	12.7c
2	888.2 lbs.	10	1110 lbs. cottonseed hulls 1305 lbs. cottonseed meal 4918 lbs. corn chopps 300 lbs. alfalfa hay 291 gallons molasses	683	1.14 lbs.	13c

As was expected, but very light gains were made during the month in which the cattle were changed from the yard to pasture; this makes the average gains for the short period appear very small while in reality the gains were very satisfactory during the last thirty of the sixty days reported in the table. The original Lots I and II, made about the same gains during the period, while of those steers previously fed a medium molasses ration, those that continued to eat molasses made much larger gains than those from which the molasses was withdrawn.

After July 12th, no more molasses was fed. Commencing August 7th, the lots were fed alike; the grain ration was mixed with cut alfalfa hay, four pounds to each steer daily. This method of feeding was continued until September 1st, when both lots were started on molasses, one quart each per day. On October 3rd, cottonseed hulls were substituted for the cut alfalfa. Early in November they were eating seven pounds corn meal, five pounds cottonseed meal, two quarts of molasses and ten pounds of hulls each per day, which ration they continued to eat until December 7th, when they were loaded for shipment to Chicago. On this date Lot I averaged in weight 1247.5, and Lot II, 1216.5. They were sold December 23rd, 1905, at $6.00 per hundred.

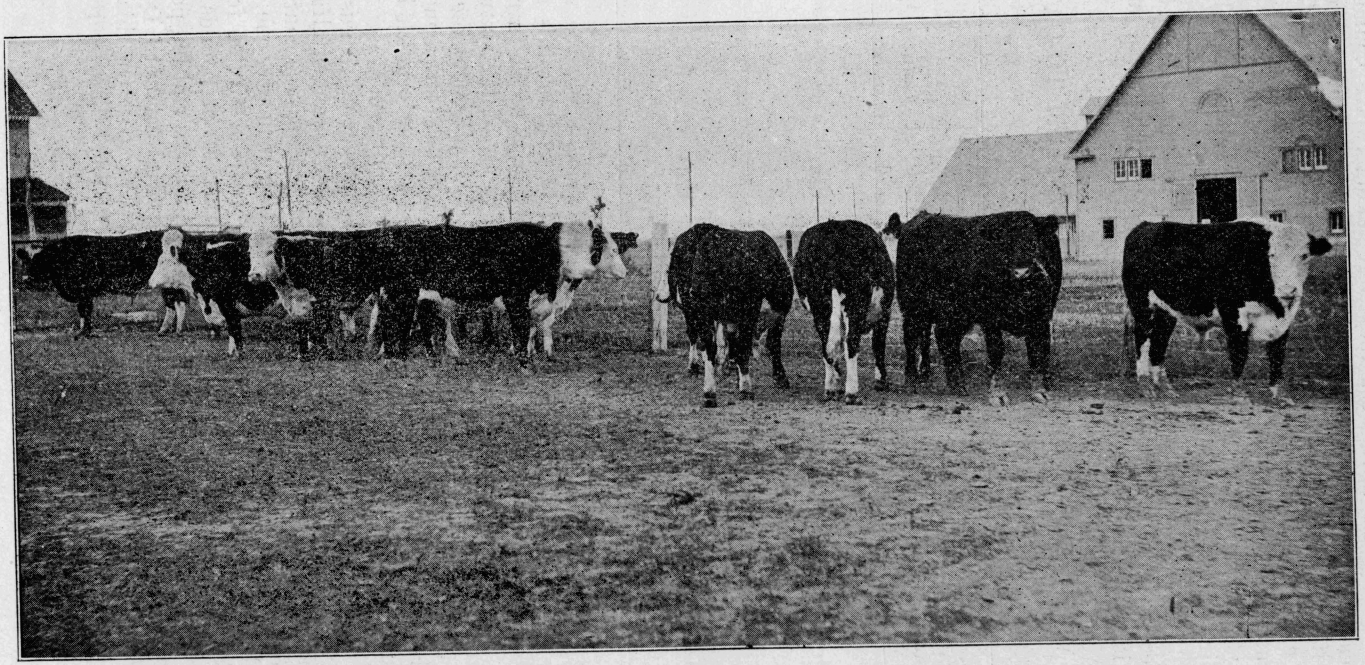

Plate VI.—The lot of steers that brought $6.00 in Chicago after having been used in Experi ments II and III.

Plate VII.—The six head that were fed the heaviest molasses ration and made the greatest gains in February, March and April, as they appeared on December 1st. Same cattle shown in Plate III, photographed May 1st.

Plate VIII.—Six head (Lot II) fed light ration of molasses until May 9th, as they appeared December 1st. Same cattle shown in Plate IV., photographed May 1st.

Plate IX.—Six head (Lot III) fed no molasses in experiment II, as they appeared December 1st. Same cattle shown in Plate V, photographed May 1st.

MOLASSES AS A HORSE FEED.

In Bulletin 125, of the Office of Experiment Stations, Dr. Langworthy states: "In this connection the experiments reporting the successful feeding of cane molasses to over four hundred work horses at a sugar plantation in the Fiji* Islands, are of interest. As high as 30 pounds of molasses were fed per head daily at different times, but the ration finally adopted consisted of 15 pounds of molasses, three pounds of bran and four pounds of maize. In addition green sugar cane tops were fed. The health of the horses remained excellent. Molasses did not cause diarrhoea but rather constipation which was counteracted by feeding bran. Feeding molasses effected a saving of over $45.00 per head per annum. However, it was believed that such a saving was possible only by reason of large quantities of waste molasses and valueless cane tops available on the spot. In discussing these experiments the following statements were made:"

"For working horses the sugar in cane molasses is a satisfactory substitute for starchy food, being readily digested ******** and 15 pounds can be given to a 1,270-pound working horse with advantage to the health of the animal and to the efficiency of its work. It produces no undue fattening, softness nor injury to the wind. The high proportion of salts in it has no injurious effect. An albuminoid ratio as low as 1:11.8 has proven highly suitable for heavy continuous work when a sufficient quantity of digestible matter is given."

According to W. C. Stubbs,[a] of the Louisiana Stations, cane sugar molasses has been used extensively with success for a number of years for feeding horses and mules in Louisiana, many feeders keeping

*Agr. Gaz. New South Wales, 9 (1898), p. 169.

[a] Loc. cit.

mules exclusively on a ration of rice bran and molasses in addition to cow-pea hay." The general custom is to feed the molasses from a large trough, allowing the mules to eat it ad libitum. It is said they will consume with apparent relish from eight to twelve pounds per head daily. The mules at the Louisiana stations have been fed molasses daily ad libitum for eight or ten years, and, according to Director Stubbs, show its good effects "in their splendid condition, lively action and endurance of work."

In this connection it is interesting to note the results obtained by G. E. Griffin[b] in the experimental feeding of cane sugar molasses to army horses in Porto Rico. In accordance with the local custom this material was fed with chopped grass, the ration being gradually substituted for the usual ration of oats and hay. The molasses was diluted with twenty-five per cent of water, and as much as possible was mixed with the chopped grass. The remainder was added to the drinking water. The test reported continued for some five months and led to the deduction that 35 pounds of grass and 13 to 15 pounds of molasses daily per 1,000 pounds live weight, is sufficient to maintain a horse in good condition in a climate like that of Porto Rico. This method of feeding, it was believed, had some disadvantages, which were as follows:

Molasses attracts insects, notably flies and ants; it sticks to the animal's coat, smears his face and breast, halter and halter strap, soils the clothing and equipment of the men and causes some trouble and delay in mixing with the grass which must be cut fine."

Cane molasses should not be regarded merely as an appetizer. It is a cheap source of the nutrients required to balance a cottonseed meal and hulls ration, and with ordinary precautions can be used in liberal amounts.

Molasses for Swine.—On February 1st, 1906, an experiment was commenced to test different methods of feeding cottonseed meal to swine. One check lot was fed on corn chops alone, another on a mixture containing 2-3 corn chops and 1-3 cottonseed meal, while another lot was fed a similar grain ration with molasses added. The ten hogs so fed ate as much as six quarts molasses at a time when they were also receiving 25 pounds corn and 12½ pounds cottonseed meal. That this lot of animals fattened more rapidly than the others is shown in the following record:

[b] Amer. Vet. Rev. 25 (1901-2), p. 894.

TABLE VIII.—GAINS OF THREE LOTS OF PIGS FED CORN, CORN AND COTTONSEED MEAL, AND CORN, COTTONSEED MEAL AND MOLASSES RESPECTIVELY.

No. of Lot	No. Pigs in Lot	Average Wt. at Start	Feed Eaten	Total Gain	Av. Daily Gain per Pig	Cost per lb. Gain
1	10	121 lbs.	2239½ lbs. corn chops fed 57 days	289	.51 lbs.	8.14c
2	10	124 lbs.	1524 lbs. corn chops 703 lbs. cotton seed meal fed cottonseed meal 57 days	380	.66 lbs.	7c
4	10	126 lbs.	1325 lbs. corn chops 390 lbs. cotton seed meal 169½ quarts molasses fed cottonseed meal 43 days	427	.82 lbs.	6.32c

EXPERIMENT IV.—ROUGH RICE FOR STEER FEEDING.

In 1904, a good deal of rice was damaged by rain at harvest time. A good many letters were received asking for information regarding the feeding value of rough rice that was too seriously discolored for marketing. Bulletin 76 contained the results of many tests of rice by-products, including hulls, but there was no record of an actual test of rough rice.

Commencing March 1st, 1905, fifteen yearling steers divided into three lots were fed for seventy days as follows:

Lot I. Cottonseed meal and cottonseed hulls.
Lot II. Cottonseed meal, rough rice and cottonseed hulls.
Lot III. Rough rice and cottonseed hulls.

During the first four weeks the rough rice was fed whole mixed with cottonseed hulls. It was necessary to mix some meal with this ration to induce the steers to eat it. A good deal of rice appeared in the droppings, and as soon as arrangements could be made grinding was commenced. The rice used was charged at cost, $20.00 per ton. Other feeds were charged at same prices as on page 9. The following table gives the result of this test:

TABLE IX.—RESULTS OF A SEVENTY-DAY TRIAL OF FEEDING GROUND ROUGH RICE TO YEARLING STEERS.

No. of Lot	No. Steers	Average Wt. at Start	Feed Eaten	Total Gain	Av. Daily Gain per Head	Cost per lb. Gain
1	5	668 lbs.	3620 lbs. cotton seed hulls 1480 lbs. cotton seed meal 460 lbs. alfalfa	477	1.36 lbs.	5.9c
2	5	691 lbs.	3620 lbs. cotton seed hulls 702 lbs. cotton seed meal 605 lbs. whole rice 1232 lbs. ground rice 760 lbs. alfalfa	532	1.52 lbs.	7.15c
3	5	679 lbs.	2445 lbs. cotton seed hulls 128 lbs. cotton seed meal 1042 lbs. whole rice 2040 lbs. ground rice 760 lbs. alfalfa	490	1.4 lbs.	9.01c

With cottonseed hulls for roughage it required 2.3 pounds of rough rice to equal one pound of cottonseed meal in this test. If the rice were charged at $10.00 per ton, the gains would cost the same as in the lot eating cottonseed meal and hulls.

This is by no means conclusive evidence as to the feeding value of rough rice. Fed with alfalfa, cow-pea or pea-nut hay, it should be worth more than when fed with cottonseed hulls. Compared to cottonseed meal when feeding with hulls it lacks both in composition and the physical qualities which cause meal to be so heartily relished.

PROFITS FROM DIFFERENT SYSTEMS OF FEEDING CATTLE.

The majority of the cattle fattened in Texas are put into feed lots as three, four or five year olds, fully grown, and show less breeding than the bulk of the more highly bred calf stock so much prized by corn belt feeder buyers. These mature cattle are fed from 90 to 180 days, and while not usually sold as top stuff, are as well finished as it pays to make animals of their class. Recent high prices of feeds and low prices of cattle have caused many feeders who have heretofore used only meal and hulls, to investigate some of the cheaper feeds on the market. Some ranchmen in the kaffir corn and milo maize districts have fed yearlings at a fair profit. Others have lost heavily by summer feeding of cottonseed cake to steers running on short grass.

The dates at which the experiments reported in this bulletin were inaugurated rendered it impossible, except in one case to have the cattle

ready for the spring market. All of them have been fed through one summer. The car load of two-year-olds reported on page 22 as bringing $6.00 per hundred, were handled at a loss of over $10.00 per head. The native pastures of Central Texas are not to be relied upon, and purchased feeds have been too high in price during the past two years to permit of their use except for rapid fattening.

At the same time the load just referred to was marketed we sold a car of fat yearlings at $5.00 per hundred. They were raised on Laureles ranch at Corpus Christi, and shipped to the Station in March, then weighing on an average of 689 pounds. They had learned to eat before weaning and received cottonseed and bran. Their average weight in Chicago on December 23rd was 1096 pounds, and their feed bill, which included cottonseed meal and hulls, corn, alfalfa and molasses, at the same prices as shown on page 9, was $34.73 per head. These yearlings were handled under practically dry lot conditions and their yielding a profit when the older cattle showed a loss, is due to the fact that they grew and fattened at the same time and also that they were crowded from the start. Their average daily gain from April 1st to December 1st was 1.8 lbs.

In the stock farming sections of the state where a variety of crops suitable for young animals can be grown, the fattening of yearlings is likely to be more profitable than the handling of older cattle. The system, however, requires that the stock used be well bred; first, they must fatten while growing, and second, they must have the quality and conformation to make them suitable to the buyers for the best trade. The sooner the calves are taught to eat the better, and they must never suffer a setback.

It is a debatable point whether kaffir corn and milo maize raised on ranches may not prove more profitable when used for the breeding herd than when fed to market stock. There are seasons, however, when the breeding animals require only a part of the crop raised and in such seasons if such feeds as oats, cotton seed, bran or alfalfa are reasonable in price, kaffir corn and milo maize will bring more marketed as beef than it would if sold for shipment.

When supplementary feeds are high in price, a surplus of the home grown grain crops can be more satisfactorily fed to older fattening animals, provided the pasture is such as to allow the animals to secure a good fill at all times.

SUMMARY.

I. In our experiments the addition of molasses to a fattening ration has always produced an increased gain.

II. Addition of molasses to a ration of cottonseed meal and hulls lowered the cost of gains.

III. When molasses was added to a balanced ration it gave larger gains and proved the appearance of the cattle but did not lower the cost of gain.

IV. There was no undesirable result from feeding yearling steers one gallon of molasses each per day, and there is good reason to believe that larger amounts might be used.

V. In experiment II the cheapest gains in each month were made by the lot receiving most nearly a balanced ration.

VI. Molasses returned from 3 to 30 cents per gallon. The lower value was obtained when molasses was added to a ration already balanced and when, in the early part of the feeding period, an unbalanced ration was fed the higher value was obtained.

VII. When cottonseed hulls were used as roughage, a ton of rough rice was equal to one-half a ton of cottonseed meal.